Appendix A

Data Collection Forms

Appendix A

Data Collection Forms

This appendix presents three items related to collecting the information on the contaminant inventories.

The first item is a blank, five-page data collection form. One data form was completed for each identified waste stream disposed of in the SDA. Continuation pages were added to the form as necessary. The CIDRA database was modeled after this form. Completed forms for all identified waste streams are stored in CIDRA and constitute Appendix B of this report.

The second item is a list of the general physical forms represented in the waste. The list is used in the database compilation of the inventory to facilitate the rollup of all waste streams having a similar physical form, regardless of the generator or building that produced the waste.

The third item is a list of the general container types used for the waste at the SDA. The abbreviations match those used in the RWMIS database.

DATA INPUT FOR RECENT AND PROJECTED DATA TASK FOR RWMC SUBSURFACE DISPOSAL AREA

PART A - GENERAL INFORMATION

1. Preparer _____

2. Date prepared _____

3. Generator _____
(area or contractor - use code from attached list)

4. Particular facility _____
(building number - use code from attached list)

5. Number of the waste stream from this facility
_____

6. Waste stream _____
_____
_____
_____
_____

7. Type of radioactive waste (check box)
☐ TRU or suspect TRU
☐ LLW
☐ non-radioactive

8. Actual years disposed of at SDA
Starting year _____ Ending year _____

9. Waste stream volume
Amount _____ Units _____
Check box: ☐ annual or ☐ total over all years
Check box: ☐ container volume or ☐ waste volume

10. Comments (specify number of pertinent question) _____
_____
_____
_____
_____
_____
_____

PART B - WASTE STREAM CHARACTERISTICS

1. General physical form (see attached list)

☐ other (specify) _____

2. Details on physical form (particularly confinement related)

3. Chemical form _____

4. Inner packaging: ☐ plastic bag ☐ plastic liner ☐ metal liner
☐ none ☐ other (specify) _____

5. Waste container type (see attached list)

6. Other characteristics of interest _____

7. Comments (specify number of pertinent question) _____

PART C - NONRADIOLOGICAL CONTAMINANTS

For each contaminant, complete at least one line on the following table. If any entries for that contaminant vary by year, fill out additional lines as needed to cover the varying entries for different years. For example, if the annual quantity disposed was x kg for 1952–56 and y kg for 1957–84, use two lines to handle this situation.

Contaminant and CAS Registry Number	Physical Form	Chemical Form	(A)Annual/ (T)Total Quantity	Units	Begin Year	End Year	Samples? Y/N*	Minimum Value or No. of Samples*	Maximum Value or Std. Dev.*	Basis for Uncertainty

* If sample data are available, mark Y in the column titled "Samples?" and provide number of samples in the next column and standard deviation in the next column. If not, mark N and give the minimum value and maximum value.

Additional information or explanations (indicate pertinent contaminant)_____

_____

_____

_____

_____

PART D - RADIOLOGICAL CONTAMINANTS

Radionuclide	Physical Form	Chemical Form	(A)Annual/ (T)Total Quantity	Units	Begin Year	End Year	Waste Gen. Fore-cast used? Y/N**	Samples? Y/N*	Minimum Value or No. of Samples*	Maximum Value or Std. Dev.*	Basis for Uncertainty

* If sample data are available, mark Y in the column titled "Samples?" and provide number of samples in the next column and standard deviation in the next column. If not, mark N and give minimum value and maximum value.

** For the projected waste streams, mark Y if forecast document was used. If not, mark N. This column is not used for the recent waste streams.

Additional information or explanations (indicate pertinent contaminant). _____

PART E - SOURCES OF INFORMATION AND UNCERTAINTIES

1. Type of source of information
(check box)

☐ RWMIS ☐ other database
☐ sample analysis data
☐ operating records ☐ interview
☐ expert judgment ☐ reports
☐ generator forecasts
☐ other (specify) _____

2. Details concerning source [names, report no., dates, etc.]

_____
_____
_____
_____
_____
_____

3. Do the estimates of contaminant quantities in Part C and D represent:
(check box)
☐ best estimate
☐ worst case
☐ other (specify) _____

4. If other than best estimate, explain why _____
_____
_____
_____

5. Do the data conflict with RWMIS?
☐ no
☐ yes

6. If yes, explain why _____
_____
_____

7. Major unknowns in inventories of contaminants _____
_____
_____
_____
_____
_____

8. Key assumptions used to deal with the unknowns _____
_____
_____
_____
_____
_____
_____

CONTINUATION PAGE

Continuation of Part _____, Column or Question Number or Title _____

GENERAL PHYSICAL FORMS FOR
WASTE BURIED IN THE SUBSURFACE DISPOSAL AREA

Number	Form
1	Irradiated fuel rods from experiments
2	Irradiated fuel from experiments
3	Unirradiated fuel from experiments
4	Irradiated end boxes
5	Other core, reactor vessel, and loop components
6	Ventilation systems
7	Lead
8	Beryllium
9	Zirconium
10	Other scrap metals
11	Sludge
12	Resin
13	Vermiculite and other sorbents
14	Evaporated salts
15	Other liquid setups
16	Graphite
17	Reactive metals
21	Combustibles (paper, cloth, wood, etc.)
22	HEPA filters
23	Other filters
24	Biological waste
31	Radiation sources
41	Concrete, brick, asphalt
42	Glass
43	Soil
44	Plastics
45	Rubber
46	Soot, ash
47	Asbestos
51	Liquids
52	Unknown
53	Other

WASTE CONTAINER TYPES

These container types/abbreviations were used to describe the physical containment associated with the waste. These terms are standard terminology for the waste data entered into the RWMIS database and are also used in the CIDRA database. The following is a listing of the waste container types and their abbreviations:

BAL	Bale (result of NRF compaction)(not valid after 1/87)
BIN	Bin (other than WERF ONLY bins)
BXC	Cardboard box (to WERF ONLY)
BXW	Wooden box
PB2	Wooden box, 64 ft^3, 4 x 4 x 4 ft
PB3	Wooden box, 64 ft^3, 2 x 4 x 8 ft
I	Insert
O	Other
BLX	Bale (result of RWMC compaction)
ING	Ingot (from WERF only)
MWB	Metal waste bin (to or from WERF ONLY)
BXM	Metal box
BXS	Steel box (from WERF ONLY)
DMP	Dumpster (to WERF ONLY)
CAR	Cargo container (to WERF ONLY)
BLM	Metal barrel, (after 9/89 for barrels other than 55 gal)
RDL	Metal barrel, 55 gal, with liner
RD5	Metal barrel, 55 gal, without liner
DDB	DOT-7A D&D bin (to WERF ONLY)

Appendix B

Complete Printout of the Contaminant Inventory and Other Information from the CIDRA Database

Appendix B

Complete Printout of the Contaminant Inventory and Other Information from the CIDRA Database

This appendix contains a complete printout of the CIDRA database covering the time period of 1984–2003. The contaminant inventory and other information is provided in its entirety in Volumes 2 and 3 of this report. The information is organized by generator and by waste stream for a given generator. The database contains completed versions of the five-part blank forms shown in Appendix A for all identified waste streams.

In the main report, the rollup printouts from CIDRA for the time period of 1984–2003 were presented using scientific notation, with two significant digits shown. In the original data forms presented here, conventional notation is used. More than two digits are shown in Parts C and D because of the need to express very small activities of certain radionuclides. However, generally speaking, only the first two digits of each entry are considered significant, at best.

NOTE: Because of its size, distribution of Appendix B has been limited. A copy of the volumes containing Appendix B can be provided on request.

Appendix C

Untitled

Appendix C

Untitled

This appendix contains no information for this report covering the RPDT. The appendix exists only for the purpose of maintaining format similarities with the INEL HDT report,[a] which covers the waste buried at the SDA from 1952 through 1983. In the HDT report, Appendix C discussed the inventory of plutonium, americium, and uranium in waste from the Rocky Flats Plant that was buried at the SDA from 1954 through 1972. However, during the 1984–2003 time period covered in the present report, no waste from the Rocky Flats Plant has been or is expected to be buried at the SDA.

a. Lockheed Idaho Technologies Company, 1995, *A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952–1983*, INEL-95/0310, Rev. 1, formerly EGG-WM-10903, August 1995.

Appendix D

Untitled

Appendix D

Untitled

This appendix contains no information for this report covering the RPDT. In the HDT report, Appendix D discussed contaminants whose presence in the waste was identified but whose quantities could not be estimated reliably. For the time period 1984–2003, no contaminant entries were identified for which reliable estimates of the quantities were not possible. This appendix was retained, however, for two reasons. First, it maintains symmetry between the HDT report[a] and this report. Second, this appendix is reserved for detailed evaluation of future unknown contaminant quantities, should they be identified at a later date and this report be revised.

a. Lockheed Idaho Technologies Company, 1995, *A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952–1983*, INEL-95/0310, Rev. 1, formerly EGG-WM-10903, August 1995.

Appendix E

Assumed Distributions of Generic Terms and Dual Entries for Radioactivity in the RWMIS Shipping Record Rollups, for Use in the CIDRA Versus RWMIS Comparisons

Appendix E

Assumed Distributions of Generic Terms and Dual Entries for Radioactivity in the RWMIS Shipping Record Rollups, for Use in the CIDRA Versus RWMIS Comparisons

The RWMIS shipping records contain some generic entries (MAP, MFP, and unidentified beta-gamma during the recent time period) for some of the radioactivity in the waste. Realistic comparisons of the activities of radionuclides in CIDRA against those in RWMIS require that the generic entries first be replaced conceptually by radionuclide distributions. The distributions used in the comparisons for each major waste generator during the recent time period are provided in this appendix.

For the purpose *only* of the comparisons, the generic entries in RWMIS were replaced conceptually using the simplified method described below. *The conceptual replacement of the generic entries does not replace or affect the detailed distributions used in CIDRA in any way, nor were the generic entries in RWMIS actually replaced.*

The method used to conceptually replace the generic entries in RWMIS was based on a simplified application of the radionuclide distributions in CIDRA. For several major waste generators (TAN, TRA, NRF, ANL-W), the distributions in CIDRA generally differ from one waste stream to another because nuclear physics calculations were used to develop the distributions. For these generators, simplified (approximate average) distributions were developed and used in these comparisons to replace the RWMIS generic entries for the given generator.

For ICPP, fixed distributions generally had been used by the data gatherer each time a generic entry was identified in the records (see Section 2.5.3). The same radionuclide distributions were used for the comparisons as were used when the information was entered into CIDRA. Other generators were handled similarly in the comparisons.

RWMIS also contains some dual-radionuclide entries (e.g., Zr-Nb-95). The assumptions made for such entries in the comparisons are also listed in this appendix.

A. ASSUMED DISTRIBUTIONS OF DUAL-RADIONUCLIDE ENTRIES IN RWMIS

RWMIS entry	Assumed distribution	Remarks
Zr-Nb-95	0.5 Zr-95, 0.5 Nb-95	Assumed to be in equilibrium
Sr-Y-90	0.5 Sr-90, 0.5 Y-90	Assumed to be in equilibrium
Ce-Pr-144	0.5 Ce-144, 0.5 Pr-144	Assumed to be in equilibrium
Ru-Rh-106	0.5 Ru-106, 0.5 Rh-106	Assumed to be in equilibrium
Ba-La-140	0.5 Ba-140, 0.5 La-140	Assumed to be in equilibrium
Sr-89-90	All Sr-90	Conservative assumption[a]
Ce-141-144	All Ce-144	Conservative assumption[a]

B. ASSUMED DISTRIBUTIONS OF GENERIC RADIONUCLIDE TERMS IN RWMIS

(Totals may not always add to exact unity because of round-off.)

1. TAN

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	1.4E+00	Co-60	0.622
		Mn-54	0.266
		Co-58	0.112
		Total	1.000
MFP	3.8E+02	Sr-90	0.492
		Cs-137	0.431
		Cs-134	0.0657
		Ce-144	0.0102
		Ru-106	0.0011
		Total	1.000

2. TRA

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	2.7E+03	Co-60	0.53
		Ni-63	0.40
		H-3	0.06
		C-14	0.01
		Total	1.00

a. Conservative in terms of half-life and radiotoxicity.

2. TRA (continued)

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MFP	2.7E+03	Cs-137	0.69
		Ce-144	0.22
		Sb-125	0.04
		Eu-155	0.032
		Sr-90	0.012
		Tc-99	0.0009
		I-129	$5x10^{-8}$
		Total	1.00
Unidentified beta-gamma	1.4E+02	Co-60	0.41
		Ni-63	0.31
		Cs-137	0.15
		H-3	0.05
		Ce-144	0.05
		C-14	0.009
		Sb-125	0.008
		Eu-155	0.007
		Sr-90	0.003
		Ni-59	0.0004
		Tc-99	0.0002
		I-129	$2x10^{-8}$
		Total	1.00

3. ICPP

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	8.0E-03	Co-58	0.500
		Mn-54	0.500
		Total	1.000
MFP	1.3E+02	Ce-144	0.197
		Pr-144	0.197
		Cs-137	0.100
		Sr-90	0.100
		Y-90	0.100
		Ru-106	0.100
		Rh-106	0.100
		Sb-125	0.044
		Zr-95	0.031
		Nb-95	0.031
		Total	1.000

4. NRF

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	6.0E-02	Ni-63	0.50
		Co-60	0.30
		Fe-55	0.15
		Co-58	0.025
		Ta-182	0.025
		Total	1.00

5. ANL-W

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	1.7E+02	Co-60	0.55
		Cr-51	0.20
		Mn-54	0.15
		Co-58	0.10
		Total	1.00
MFP	3.1E+02	Sr-90	0.50
		Cs-137	0.30
		Ce-144	0.20
		Total	1.00
Unidentified beta-gamma	1.2E-03	Sr-90	0.50
		Cs-137	0.30
		Ce-144	0.20
		Total	1.00

6. OTHER

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MAP	2.2E+01	Co-60	0.75
		Fe-59	0.25
		Total	1.00

6. OTHER (continued)

Term	RWMIS activity (Ci)	Assumed distribution	
		Nuclide	Fraction
MFP	2.9E+02	Cs-137	0.50
		Sr-90	0.50
		Total	1.00
Unidentified beta-gamma	2.5E-01	Co-60	0.375
		Cs-137	0.25
		Sr-90	0.25
		Fe-59	0.125
		Total	1.000

Appendix F

Summary of Results of Environmental Monitoring at the Subsurface Disposal Area

Appendix F

Summary of Results of Environmental Monitoring at the Subsurface Disposal Area

This appendix provides summary tables of environmental monitoring results at the SDA. The purpose of these summary tables is to provide a broad indication of what contaminants have been detected in the monitoring, for comparison with the data compiled in CIDRA. Separate tables are given for radiological and nonradiological contaminants. Within each table, separate entries are also provided for the results of routine monitoring and special studies because the statistical criteria often varied from one study to another.

The radiological contaminants, which are presented in Table F-1, include those most frequently detected in RWMC environmental samples and others included in routine screening tests. Monitoring data included in this review span 18 years (1976 through 1993); however, only years for which detectable levels were reported appear in Table F-1.

Because Table F-1 is a high-level rollup table for comparison purposes only, the minimum and maximum reported values of concentration were compiled for each medium by combining the results from all of the sampling methods. If only one sample was evaluated, only the single result is listed in the table. Air contaminant concentrations include data from both high- and low-volume air samplers. Soil concentrations include both surface and near-surface values. Concentrations in subsurface sediments (deeper than near-surface) are reported separately. Contaminant concentrations in samples from all monitoring wells were combined to report a range of concentrations. No distinction between sampling locations within the SDA, monitoring instrumentation, sampling locations, or number of positive samples was considered in this rollup table. Only a gross range in concentration values is presented.

The environmental medium terms for the subsurface (groundwater, subsurface water, perched water, etc.) used in the routine monitoring and special studies reports have not always been defined clearly or used consistently. Since the purpose here is simply to indicate which contaminants have been detected, not the environmental media in which they were detected, no attempt is made to define what is meant by the various terms. The contaminant concentrations are presented with their associated environmental medium term used in the cited report.

Below-measurable concentrations are denoted as BDL (below detection limit). Detection limits for major radiological contaminants monitored at the SDA are included in the annual monitoring reports. Significant concentration results generally reflect a 95% confidence level, and the uncertainty for analytical results is $\pm 2\ \sigma$ for radionuclides. Data reported for biotic vegetation and air sampling are provided by analyses conducted by RESL.

Results of routine monitoring and special studies for nonradiological contaminants are summarized similarly in Table F-2. Monitoring for nonradiological contaminants is smaller in scope than monitoring for radiological contaminants. Organic compounds and metals have been

monitored regularly at the SDA since 1987. Special studies cover the years listed in Table F-2. Maximum and minimum contaminant concentrations are presented for each medium sampled.

Generally, data reported for nonradiological contaminants reflect an uncertainty of $\pm 1\ \sigma$. Below-measurable levels are indicated as PQL (practical quantitation level). PQL values for nonradiological contaminants measured in the SDA are given in the annual monitoring reports.

The detection of contaminants in environmental media at the RWMC does not always imply that the contaminants came from the SDA waste that is inventoried herein. Contaminants detected in the analysis of environmental samples collected at the RWMC could have also resulted from (a) emissions from other INEL facilities, (b) atmospheric fallout from weapons testing, (c) natural occurrence, (d) cross-contamination or erroneous laboratory analysis, or (e) waste located in other parts of the RWMC. Eliminating the other potential sources of contamination requires rigorous design and execution of the sampling and analysis, and careful interpretation of the results. Such evaluations are beyond the scope of these simplified comparisons.

The special studies cited here and the RESL data are believed to be of acceptable reliability for use in these comparisons. The subsurface water sampling and analysis by the USGS is also believed to be of acceptable reliability in this regard. However, in spite of rigorous monitoring activities, contaminants in aquifer samples collected by the USGS at the RWMC could have been the result of waterborne effluents upgradient from other INEL facilities. A case-by-case analysis is required to postulate the source of each detected contaminant.

The data from INEL contractor routine monitoring at the RWMC before about 1983 are considered to be of lower reliability. Quality assurance of the monitoring activities was minimal. In many cases, no control samples were collected or the control samples were from inappropriate locations. In 1983, detailed reviews of the objectives, procedures, and data were completed for the INEL contractor monitoring activities at the RWMC, leading to major improvements in sampling design, laboratory analysis, and data evaluation. Quality assurance was strengthened substantially. The monitoring activity reviews continue to be held on a regular basis. For the INEL contractor routine monitoring, only data obtained in 1984 or later are considered sufficiently reliable for these comparisons. The early data that are affected include contaminant concentrations in air, subsurface and surface water, and subsurface and surface soil. For the present comparisons, the biotic data from all years are considered reliable.

The summary environmental monitoring data are not compared here against background concentrations of the contaminants. Some of the listed detections may simply represent concentrations of contaminants at background levels.

Table F-1. Summary of results from routine monitoring and special studies for radiological contaminants.

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Ac-228	Aquifer	(EMU) 1979	(2.2±1.7)E-07 µCi/mL
Ag-110m	Air	(EMU) 1980	(0.26±0.10 to 0.39±0.12)E-13 µCi/mL
	Surface water	(EMU) 1977	6.0E-10 µCi/mL
	Soil	(EMU) 1979–1980	BDL to (1.12±0.32)E-07 µCi/g
Am-241	Aquifer	(EMU) 1976, 1981, 1982, 1984, (SS) 1987	(1.5±0.6)E-11 to (2.0±1.0)E-10 µCi/mL BDL to (5.3±1.3)E-10 µCi/mL
	Perched water	(SS) 1976–1977	BDL
	Surface water	(EMU) 1977, 1983–1985, 1990, 1991, 1992, 1993 (SS) 1984	(1.2±0.2)E-10 to 2.5E-08 µCi/mL (88.6±7.2)E-08 µCi/mL
	Surficial sediment	(SS) 1989	(13±2 to 154,000±3,000)E-15 Ci/g
	Subsurface sediment	(SS) 1975–1977, 1985–1988, 1989	BDL to (1.55±0.4)E-03 µCi/g
	Soil	(EMU) 1977–1981, 1984, 1986, 1988, 1991, 1992 (SS) 1986, 1989, 1992	BDL to (981.0±82.0)E-07 µCi/g (8.0±2.0)E-9 to (1.54±0.03)E-04 µCi/g
	Biotic—vegetation	(EMU) 1984, 1986, 1987, 1990, 1991, 1992, 1993	BDL to (3.9±0.6)E-08 µCi/g
	Biotic—soil	(EMU) 1984–1986, 1990	4.0E-08 to (32.0±3.0)E-06 µCi/g
	Biotic—tissue	(EMU) 1987, 1989	BDL to (4.7±0.3)E-07 µCi/g
	Air	(EMU) 1978–1981, 1984–1993	(1.6±0.4)E-17 to 9.8E-14 µCi/mL
Ba-140	Air	(EMU) 1980	(5.0±2.0 to 8.0±4.0)E-15 µCi/mL
Ce-141	Aquifer	(EMU) 1983	(0.180±0.075)E-06 µCi/mL
	Perched water	(SS) 1976–1977	BDL
	Surface water	(EMU) 1977, 1981	5.6E-08 to (3.08±2.56)E-09 µCi/mL
	Soil	(EMU) 1979–1981	(0.65±0.27 to 4.81±1.94)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983–1984	(0.49±0.2)E-15 to 7.90E-14 µCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Ce-144	Perched water	(SS) 1976–1977	BDL
	Subsurface sediment	(SS) 1975–1978	BDL to (3.92±0.57)E-07 µCi/g
	Surface water	(EMU) 1976–1979	(35.4±7.4)E-09 to 1.3E-06 µCi/mL
	Soil	(EMU) 1978–1981	(1.16±0.47 to 117.0±36.0)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983–1984	(0.7±0.4)E-15 to 3.93E-12 µCi/mL
Co-58	Soil	(EMU) 1978–1981	(0.41±0.4 to 1.40±0.45)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983, 1985	(0.67±0.15)E-15 to 1.04E-13 µCi/mL
Co-60	Aquifer	(EMU) 1980 (SS) 1987	(0.11±0.10)E-07 µCi/mL BDL
	Perched water	(SS) 1976–1977	BDL
	Subsurface sediment	(SS) 1976–1988, 1989	BDL to 2.8E-04 pCi/g
	Surface water	(EMU) 1977	(1.80)E-09 µCi/mL
	Surficial sediment	(SS) 1989	(24±8 to 360±17)E-15 Ci/g
	Soil	(EMU) 1977–1981 (SS) 1978, 1986	(1.25±0.61 to 266.0±8.0)E-07 µCi/g BDL to (9.23±0.31)E-07 µCi/g
	Biotic—vegetation	(EMU) 1983	(0.7±0.2 to 1.0±0.3)E-06 µCi/g
	Biotic—soil	(EMU) 1984	(0.77±0.14)E-06 µCi/g
	Biotic—tissue	(EMU) 1987, 1991, 1992	(1.84±0.18 pCi/g to 6.7±0.7)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983, 1986	(0.89±0.32)E-15 to 1.75E-12 µCi/mL
Cr-51	Surface water	(EMU) 1977	5.30E-09 µCi/mL
	Soil	(EMU) 1978–1981	(4.63±2.76 to 19.3±5.9)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983	(4.94)E-15 to 1.80E-12 µCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Cs-134	Surface water	(EMU) 1977, 1979, 1981	(0.89±0.69 to 8.6±1.04)E-09 µCi/mL
	Soil	(EMU) 1978–1981	(0.68±0.33 to 16.1±0.57)E-07 µCi/g
	Biotic—vegetation	(EMU) 1987	(1.07±0.14 to 1.5±0.2)E-07 µCi/g
	Air	(EMU) 1978–1981, 1985	(1.11±0.46)E-15 to 1.03E-13 µCi/mL
Cs-137	Aquifer	(EMU) 1976–1977, 1980, 1986 (SS) 1987	(1.6±0.7)E-08 to (0.09±0.03)E-06 µCi/mL BDL
	Perched water	(SS) 1976–1977	BDL
	Subsurface sediment	(SS) 1975–1988, 1989	BDL to (1,090±30)E-05 µCi/g
	Surface water	(EMU) 1976–1977, 1979–1981, 1983–1986, 1988, 1990, 1993	(1.4±0.4)E-09 to (202.4±0.36)E-08 µCi/mL
	Surficial sediment	(SS) 1989	(27±8 to 1,800±70)E-15 Ci/g
	Soil	(EMU) 1977–1981, 1984, 1988, 1992 (SS) 1978, 1989	(1.13±0.43)E-07 to (40±2.0)E-06 µCi/g (1.8±7.0)E-08 to (153±0.05)E-06 µCi/g
	Biotic—vegetation	(EMU) 1983–1984, 1987	(0.69±0.19)E-07 to (2.8±0.2)E-04 µCi/g
	Biotic—soil	(EMU) 1984, 1986, 1990	(8.0E-08 to 0.94±0.24)E-06 µCi/g
	Biotic—tissue	(EMU) 1987, 1991, 1992	(4.1±0.8)E-07 to (7.32±0.23)E-06 µCi/g
	Air	(EMU) 1978–1981, 1984–1985, 1987, 1991	(0.5±0.2)E-15 to (9.08±0.47)E-13 µCi/mL
Eu-152	Surface water	(EMU) 1976, 1978–1979	0.78E-09 to (1.8±0.4)E-08 µCi/mL
	Soil	(EMU) 1978–1981 (SS) 1978	(1.56±1.55)E-07 to 1.06E-06 µCi/g BDL to (2.06±0.36)E-07 µCi/g
	Air	(EMU) 1978–1981	(9.25±2.39)E-15 to (9.57±1.37)E-13 µCi/mL
	Biotic—tissue	(EMU) 1987	(14.3±1.8 to 52.4±1.8)E-07 µCi/g

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Eu-154	Subsurface sediment	(SS) 1985	(29±9)E-09 µCi/g
	Surface water	(EMU) 1976, 1979	(8.6±1.76)E-09 to (1.7±0.3)E-08 µCi/mL
	Surficial sediment	(SS) 1989	29±9E-15 Ci/g
	Soil	(EMU) 1979–1981 (SS) 1978, 1989	(1.82±0.64 to 3.20±1.21)E-07 µCi/g BDL to (2.74±0.28)E-07 µCi/g
	Biotic—tissue	(EMU) 1987	(7.4±1.3 to 39±3)E-07 µCi/g
	Air	(EMU) 1978–1981	(3.10±1.50)E-15 to (2.09±0.82)E-13 µCi/mL
Eu-155	Air	(EMU) 1981	(5.31±2.1)E-15 to (1.13±0.36)E-13 µCi/mL
	Soil	(EMU) 1981	(3.23±1.46)E-07 µCi/g
Fe-59	Aquifer	(EMU) 1976	(2.1±0.7)E-08 µCi/mL
	Soil	(EMU) 1979–1981	BDL to (2.47±0.71)E-07 µCi/g
	Air	(EMU) 1978–1981	BDL to 4.29E-13 µCi/mL
H-3	Aquifer	(EMU) 1977–1993 (SS) 1984–1986, 1987	(6.0±4.0)E-07 to (2.7±0.4)E-06 µCi/mL <BDL to (1.9±0.4)E-06 µCi/mL
	Perched water	(SS) 1976–1977 (EMU) 1992, 1993	(5.4±0.1 to 18.0±1.0)E-06 µCi/mL BDL to (0.4±0.2)E-06 µCi/mL
Hf-181	Soil	(EMU) 1978–1981	(0.30±0.27 to 4.40)E-07 µCi/g
	Air	(EMU) 1978–1981	1.21E-15 to (1.58±0.77)E-13 µCi/mL
Hg-203	Soil	(EMU) 1980–1981	(0.90±0.39 to 2.14±0.63)E-07 µCi/g
	Air	(EMU) 1978–1981	(0.54±0.43)E-15 to (0.65±0.42)E-13 µCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
I-131	Air	(EMU) 1980	BDL to (0.9±0.6)E-15 µCi/mL
Mn-54	Aquifer	(EMU) 1977	(1.8±0.7 to 1.9±0.7)E-08 µCi/mL
	Soil	(EMU) 1979–1981	(0.60±0.44 to 1.74±0.59)E-07 µCi/g
	Air	(EMU) 1978–1981, 1983	BDL to (1.19±1.03)E-13 µCi/mL
Nb-95	Surface water	(EMU) 1977	5.70E-07 µCi/mL
	Soil	(EMU) 1978–1981	(0.82±0.27 to 4.0)E-07 µCi/g
	Air	(EMU) 1978–1981	(1.22±0.18 to 3.48±1.5)E-13 µCi/mL
Pb-212	Aquifer	(EMU) 1978	(5.3±2.6)E-08 µCi/mL
Pu-238	Aquifer	(EMU) 1981, 1983 (SS) 1987	(1.0±0.8) to (8.1±0.8)E-10 µCi/mL Not detected
	Perched water	(SS) 1976–1977, 1989	BDL to (3.22±0.17)E-08 µCi/mL
	Surface water	(EMU) 1983	(0.015±0.004)E-08 µCi/mL
	Surficial sediment	(SS) 1989	(5.2±1.7 to 6,400±200)E-15 Ci/g
	Subsurface sediment	(SS) 1975–1988, 1989	BDL to (3.8±0.4)E-07 µCi/g
	Soil	(EMU) 1979–1981, 1988, 1991 (SS) 1989 (SS) 1992	(0.009±0.008 to 0.72±5.0)E-06 µCi/g (3.8±0.4)E-07 µCi/g (7.2±1.5)E-08 to (4.0±0.3)E-06 µCi/g
	Soil water	(SS) 1989	(5.3±1.3)E-10 µCi/mL
	Biotic—vegetation	(EMU) 1984, 1986–1987, 1990	BDL to (0.08±0.01)E-06 µCi/g
	Biotic—tissue	(EMU) 1987, 1989	BDL to (2.2±0.2)E-07 µCi/g
	Air	(EMU) 1980, 1986–1988	(4±1)E-18 to (5.0±0.08)E-15 µCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Pu-239/240	Aquifer	(SS) 1985–1986, 1987	BDL
	Perched water	(EMU) 1976 (SS) 1989	(0.25±0.09)E-10 µCi/mL (5.8±0.2)E-08 µCi/mL
	Subsurface sediment	(SS) 1975–1978, 1985–1988, 1989	BDL to (11±0.5)E-03 µCi/g
	Surface water	(EMU) 1983–1985	(0.016±0.006 to 0.15±0.06)E-08 µCi/mL
	Surficial sediment	(SS) 1989	(5.5±1.6 to 33,400±600)E-15 Ci/g
	Soil	(EMU) 1976–1977, 1979–1981, 1986, 1988, 1991, 1992, 1993 (SS) 1989 (SS) 1992	BDL to (0.23±0.05)E-07 µCi/g (3.34±0.06)E-05 µCi/g (6.0±1.5)E-08 to (1.16±0.07)E-05 µCi/g
	Soil water	(SS) 1989	(8±7)E-11 µCi/g
	Biotic—vegetation	(EMU) 1986, 1987, 1990	(1.0±0.2)E-08 to (1.05±0.08)E-06 µCi/g
	Biotic—soil	(EMU) 1984, 1986–1990	(4.0E-08 to 16.5±0.8)E-06 µCi/g
	Biotic—tissue	(EMU) 1987, 1989	(2.7±0.8 to 30±2)E-08 µCi/g
	Air	(EMU) 1980, 1984–1988, 1990–1993	(2.0±0.6)E-18 to (1.8±0.1)E-15 µCi/mL
Ru-103	Surface water	(EMU) 1977, 1981	(2.78±0.79)E-09 to 1.40E-07 µCi/mL
	Soil	(EMU) 1978–1981	(0.70±0.38 to 3.50)E-07 µCi/g
	Air	(EMU) 1978–1980, 1983	(1.07±0.93)E-15 to 1.12E-13 µCi/mL
Ru-106	Surface water	(EMU) 1976–1977, 1979	(30±11 to 32.2±6.2)E-09 µCi/g
	Soil	(EMU) 1979–1981	(4.18±2.40)E-07 to 2.26E-06 µCi/g
	Biotic—vegetation	(EMU) 1978	2.44E-06 µCi/g
	Air	(EMU) 1978–1981	(14.0±3.4)E-15 to (5.88±1.83)E-13 µCi/mL
Sb-124	Soil	(EMU) 1979–1981	(0.53±0.24 to 1.13±0.43)E-07 µCi/g
	Air	(EMU) 1979–1981	(1.02±0.27)E-15 to (0.58±0.15)E-13 µCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
Sb-125	Surface water	(EMU) 1978–1981	(1.40±0.67 to 7.35±1.31)E-07 μCi/mL
	Soil	(EMU) 1978–1981	(1.40±0.67 to 7.35±1.31)E-07 μCi/g
	Biotic—tissue	(EMU) 1987	BDL to 7.8±1.2E-07 μCi/mL
	Biotic—vegetation	(EMU) 1987	(1.6±0.3 to 1.8±0.4)E-07 μCi/g
	Air	(EMU) 1978–1981, 1984	BDL to (310±100)E-15 μCi/mL
Sc-46	Soil	(EMU) 1979–1981	(0.84±0.61 to 1.78±0.65)E-07 μCi/g
	Air	(EMU) 1978–1981	(0.59±0.42)E-15 to (0.52±0.20)E-13 μCi/mL
Sr-90	Aquifer	(EMU) 1978–1979, 1985–1987 (SS) 1987	(5.0±4.0)E-09 to (0.023±0.003)E-06 μCi/mL BDL to (0.7±0.14)E-08 μCi/g
	Perched water	(EMU) 1976, 1980, 1988	BDL to (0.09±0.04)E-07 μCi/mL
	Subsurface sediment	(SS) 1975–1988, 1989	BDL to (1.28±0.04)E-06 μCi/g
	Surface water	(EMU) 1987	(<1.6±0.3)E-09 to (1.70±0.10)E-06 μCi/mL
	Surficial sediment	(SS) 1989	(58±19 to 1,280±40)E-15 Ci/g
	Soil	(EMU) 1988, 1991, 1992 (SS) 1989	(0.22±0.7 to 2.2±0.2)E-06 μCi/g (1.28±0.04)E-06 μCi/g
	Biotic—soil	(EMU) 1984	(0.11±0.01 to 0.6±01)E-06 μCi/g
	Biotic—vegetation	(EMU) 1983–1984, 1986–1987, 1990, 1992, 1993	(9±2)E-08 to 8.7E-02 μCi/g
	Biotic—tissue	(EMU) 1987, 1989	(2.5±0.3 to 6.5±0.5)E-07 μCi/mL
	Air	(EMU) 1986, 1987, 1988, 1993	(8±2)E-17 to (5.5±0.9)E-16 μCi/mL
Ta-182	Soil	(EMU) 1979–1981	(2.23±1.14 to 3.84±1.46)E-07 μCi/g
	Air	(EMU) 1979–1981	(4.30±1.78)E-15 to (3.50±1.00)E-13 μCi/mL

Table F-1. (continued).

Contaminant	Environmental medium	Years in which contaminant was sampled for and detected[a]	Concentration range
U-234	Soil	(EMU) 1986 (SS) 1992	4.0±1.0E-07 µCi/g (7.9±1.0)E-7 to (1.39±0.11)E-06 µCi/g
	Biotic—vegetation	(EMU) 1985, 1987	(2.3±0.3 to 3.9±0.5)E-08 µCi/g
	Biotic—tissue	(EMU) 1987	(2.8±0.4)E-08 to (3.6±0.4)E-07 µCi/g
U-235	Soil	(SS) 1983	(0.34±0.003 to 0.06±0.01)E-06 µCi/g
	Biotic—vegetation	(EMU) 1987	(1.6±0.5 to 2.3±0.6)E-09 µCi/g
	Biotic—tissue	(EMU) 1987, 1989	BDL to 1.4±0.2E-08 µCi/g
U-237	Air	(EMU) 1980	(1.6±1.0 to 8.0±2.0)E-15 µCi/mL
U-238	Soil	(SS) 1983–1984, 1992	(8.0±1.0)E-7 to (1.43±0.1)E-06 µCi/g
	Biotic—vegetation	(EMU) 1987	(2.9±0.4 to 4.0±0.6)E-08 µCi/g
	Biotic—tissue	(EMU) 1987, 1989	(2.5±0.4)E-08 to (1.2±0.2)E-07 µCi/g
Y-91	Soil	(EMU) 1979–1980	BDL to (934±538.0)E-07 µCi/g
	Air	(EMU) 1979–1980	(1.46±1.14)E-15 to (322±84.0)E-13 µCi/mL
Zn-65	Soil	(EMU) 1979–1981	BDL to (1.93±0.83)E-07 µCi/g
	Air	(EMU) 1978–1981	BDL to (1.11±0.90)E-13 µCi/mL
Zr-95	Surface water	(EMU) 1977	3.4E-07 µCi/mL
	Soil	(EMU) 1979–1981	(1.55±0.93 to 5.00)E-07 µCi/g
	Air	(EMU) 1978–1981	(1.54±0.66 to 168.0±8.0)E-15 µCi/mL

a. Years spanned by environmental monitoring results (EMU) presented here are 1976–1993. Results from special studies (SS) span years as shown.

BDL — Below detection limit.
EMU — Data compiled from routine monitoring results published by the Environmental Monitoring Unit.
SS — Special studies. Data compiled from studies other than those that are part of the routine monitoring program.

Table F-2. Summary of results from routine monitoring and special studies for nonradiological contaminants.

Contaminant	Medium	Years in which contaminant was detected[a]	Concentration
ORGANICS			
1,1,1-trichloroethane	Aquifer, perched	(EMU) 1987–1993 (SS) 1987–1988, 1993	<0.2 to 0.9 µg/L <0.2 to 15.0 µg/L
	Soil/soil gas	(SS) 1987	<0.01 µg/L
	Borehole vapor	(SS) 1987, 1988	BDL to 120 mg/m^3
	Air	(SS) 1991, 1994	1.4 µg/m^3
1,1,2-trichlorotrifluoroethane	Perched water	(EMU) 1987–1990 (SS) 1987–1988	37 to 250 µg/L <0.2 to 250 µg/L
	Air	(SS) 1989	120 mg/m^3
	Soil borehole vapor	(SS) 1987	PQL to 120 µg/L
	Soil/soil gas	(SS) 1987	NR to 310 µg/L
1,1-dichloroethane	Aquifer	(EMU) 1987–1993 (SS) 1987–1988, 1990–1991	<0.2 to 5.6 µg/L <0.2 to 13 µg/L 5.6 to 22 µg/L
	Perched water	(EMU) 1987–1990 (SS) 1987, 1993	5.6 to 22 µg/L 0.3 to 13 µg/L
1,1-dichloroethylene	Aquifer	(EMU) 1987–1993 (SS) 1987–1988, 1990–1991	<0.2 to 1.0 µg/L <0.2 to 3.0 µg/L
	Perched water	(EMU) 1987–1990 (SS) 1987	0.8 to 2.6 µg/L <0.8 µg/L
2-butanone	Air	(SS) 1994	0.4 µg/m^3
Acetone	Sedimentary interbed	(SS) 1987	11 µg/kg
	Air	(SS) 1994	3.0 µg/m^3
Carbon tetrachloride	Aquifer	(EMU) 1987–1993 (SS) 1987–1991	<0.2 to 2.8 µg/L <0.2 to 6.6 µg/L
	Perched water	(EMU) 1987–1990 (SS) 1987, 1988, 1993	230 to 1,400 µg/L <0.2 to 2,100 µg/L
	Air	(SS) 1987, 1989	17 to 5,800 mg/m^3
	Borehole vapor	(EMU) 1987 (SS) 1987–1988	0.1 to 36 mg/m^3 BDL to 5,800 µg/L
	Soil/soil gas	(SS) 1987, 1992	0.22 to 1,400 ppb

Table F-2. (continued).

Contaminant	Medium	Years in which contaminant was detected[a]	Concentration
Chloroform	Aquifer	(EMU) 1987–1993 (SS) 1987–1991	<0.2 to 1.0 µg/L <0.2 to 3 µg/L
	Perched water	(EMU) 1987–1990 (SS) 1987–1988, 1990–1991, 1993	300 to 940 µg/L <0.2 to 1,500 µg/L
	Air	(SS) 1989, 1994	1.7 to 320,000 $\mu g/m^3$
	Soil/borehole vapor	(SS) 1987, 1988, 1992	BDL to 330 µg/L
	Sedimentary interbed	(SS) 1987	120 µg/kg
Dichlorodifluoromethane	Aquifer	(EMU) 1987–1993 (SS) 1987–1991	<0.2 to <2.6 µg/L <0.2 to 3.0 µg/L
	Air	(SS) 1994	0.3 $\mu g/m^3$
	Perched water	(EMU) 1987–1990 (SS) 1987–1988, 1990–1991	BDL to 0.3 µg/L <0.2 to 3 µg/L
Methylene chloride	Sedimentary interbed	(SS) 1987	42 µg/kg
	Perched water	(SS) 1993	BDL to <100 µg/L
	Air	(SS) 1991, 1994	0.05 $\mu g/m^3$
Phenol	Aquifer	(SS) 1991	0.046 mg/L
Tetrachloroethylene	Aquifer	(EMU) 1987–1993 (SS) 1987, 1989–1991	<0.2 to 4.5 µg/L <0.2 to 3.0 µg/L
	Air	(SS) 1994	4.2 $\mu g/m^3$
	Perched water	(EMU) 1987–1990 (SS) 1987, 1988, 1990–1991, 1993	4.5 to 1,200 µg/L <0.2 to 230 µg/L
	Soil/borehole vapor	(SS) 1987, 1992	BDL to 62 µg/L
	Soil/soil vapor	(SS) 1987	3 to 40 µg/L
Toluene	Aquifer	(EMU) 1987–1993 (SS) 1987, 1988, 1990, 1991	<0.2 to <1.0 µg/L <0.2 to 3.0 µg/L
	Air	(SS) 1994	0.3 $\mu g/m^3$
	Perched water	(EMU) 1987–1990 (SS) 1987–1988, 1990–1991, 1993	<0.2 to 0.3 µg/L <0.2 to 100 µg/L
	Soil/borehole vapor	(SS) 1987, 1992	0.3 to 191 µg/L

Table F-2. (continued).

Contaminant	Medium	Years in which contaminant was detected[a]	Concentration
Trichloroethylene	Aquifer	(EMU) 1987–1993 (SS) 1987–1988	<0.2 to 1.4 µg/L <0.2 to 860 µg/L
	Perched water	(EMU) 1987–1990 (SS) 1987–1988, 1990–1991, 1993	BDL to 860 µg/L <0.2 to 1,600 µg/L
	Air	(SS) 1987, 1989	11 to 380 mg/m^3
	Soil/borehole vapor	(SS) 1987, 1992	BDL to 690 µg/L
	Sedimentary interbed	(SS) 1987	81 µg/kg
Trichlorotrifluoroethane	Air	(SS) 1989	24 mg/m^3
METALS			
Antimony	Perched water	(SS) 1988, 1993	2.2 to 70.0 µg/L
Arsenic	Aquifer	(SS) 1987	1 to 14.3 µg/L
	Perched water	(SS) 1988, 1993	<2.0 to 4.2 µg/L
Barium	Sedimentary interbed	(SS) 1987	392 mg/kg
	Perched water	(SS) 1988, 1993	18 to 1,260 µg/L
Beryllium	Perched water	(SS) 1988, 1993	<0.5 to 6.4 µg/L
	Subsurface soil	(SS) 1991	1.9 to 2.7 mg/kg
	Sedimentary interbed	(SS) 1987	1.4 mg/kg
Boron	Surface soil	(SS) 1982	190 mg/kg
Cadmium	Perched water	(SS) 1988, 1993	<1 to 16.1 µg/L
	Surface soil	(SS) 1982	0.50 mg/kg
Chromium	Surface water	(EMU) 1986	2.2±0.1 mg/L
	Aquifer	(SS) 1985–1986, 1987	0.05 to 56±10 µg/L
	Perched water	(SS) 1993	<6.0 to 50 µg/L
	Sedimentary interbed	(SS) 1987	40.0 mg/kg
	Soil	(SS) 1982	3.5 mg/kg
Cobalt	Perched water	(SS) 1988, 1993	<12.0 to 72.4 µg/L

Table F-2. (continued).

Contaminant	Medium	Years in which contaminant was detected[a]	Concentration
Copper	Perched water	(SS) 1988, 1993	<7.0 to 10.8 µg/L
	Soil	(SS) 1982	6.9 mg/kg
	Sedimentary interbed	(SS) 1987	30.3 mg/kg
Lead	Perched water	(SS) 1988, 1993	<5 to 21.5 µg/L
	Surface soil	(SS) 1982	8.8 mg/kg
Mercury	Subsurface soil	(SS) 1991	1.40 to 5,320 mg/kg[b]
	Perched water	(SS) 1988, 1993	<0.1 to 3.4 µg/L
	Soil vapor	(SS) 1990	ND
	Sedimentary interbed	(SS) 1987	0.6 mg/kg
Nickel	Sedimentary interbed	(SS) 1987	34.4 mg/kg
	Perched water	(SS) 1988, 1993	9 to 996 µg/L
Selenium	Sedimentary interbed	(SS) 1987	1.0 mg/kg
	Subsurface water	(SS) 1987, 1988	ND to 3 µg/L
	Perched water	(SS) 1993	1.1 to 97.9 µg/L
Silver	Sedimentary interbed	(SS) 1987	2.4 mg/kg
	Perched water	(SS) 1988, 1993	<1 to 1.6 µg/L
Thallium	Sedimentary interbed	(SS) 1987	2.4 mg/kg
	Perched water	(SS) 1988, 1993	0.9 µg/L
Tin	Sedimentary interbed	(SS) 1987	244 mg/kg
	Perched water	(SS) 1988	1,000 µg/L
Vanadium	Sedimentary interbed	(SS) 1987	53.3 mg/kg
	Perched water	(SS) 1988, 1993	<15.0 to 16.4 µg/L
Zinc	Surface soil	(SS) 1982	37.0 mg/kg
	Perched water	(SS) 1988, 1993	4.3 to 945 µg/L
	Sedimentary interbed	(SS) 1987	2.4 mg/kg

Table F-2. (continued).

Contaminant	Medium	Years in which contaminant was detected[a]	Concentration
OTHER[c]			
Chloride	Aquifer	(EMU) 1979, 1982–1993	9±1 to 105±11 ppm
	Perched water	(EMU) 1982–1993 (SS) 1993	62±6 to 93±9 ppm 4,980 to 635,000 µg/L
	Surface soil	(SS) 1982	150 mg/kg
Cyanide	Perched water	(SS) 1988	5 µg/L
	Sedimentary interbed	(SS) 1987	1.25 mg/kg
Nitrate	Aquifer	(EMU) 1982, 1983, 1987	0.5 to 12 mg/L
	Perched water	(SS) 1993	130 to 2,040 µg/L
	Surface water	(EMU) 1980–1982	0.08 to 4.7 mg/L
	Surface soil	(EMU) 1980–1983 (SS) 1982	1–49 ppm 0.28 mg/kg
Sodium ion	Surface water	(EMU) 1983–1986	6 to 100±10 mg/L
	Aquifer	(EMU) 1979, 1982–1993	6±1 to 52±5 ppm
	Perched water	(EMU) 1985–1987, 1992	BDL to 100±10 ppm
Sulfate	Perched water	(SS) 1988	1 µg/L
	Perched water	(SS) 1993	6,290 to 40,800 µg/L
	Perched water	(SS) 1985	19.95 µg/L
Sulfide	Sedimentary interbed	(SS) 1987	200 mg/kg

a. Data included in this table represent data that were actually detected in those years indicated. Occasionally, contaminants were monitored during a year, but the analyses were not available for inclusion in the annual EMU report.

b. Detections involved drilling directly into a disposal unit.

c. Contaminant monitoring occurred from 1976–1993.

BDL — Below detection limit.
EMU — Data compiled from routine monitoring results published by the Environmental Monitoring Unit.
ND — Not detected.
NR — Minimum measured concentration was not reported in the reference source practical quantitation limit.
PQL — Practical quantitation limit.
SS — Special studies. Data compiled from studies other than those that are part of the routine monitoring program at the SDA.

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Appendix G

Contaminant Profile Data Sheets

Appendix G

Contaminant Profile Data Sheets

This appendix presents the profile data sheet for carbon-14 (C-14).

The interested reader is referred to the HDT report[a], Appendix G, which presents the profile data sheets for the other contaminants that were among those present in large quantities in the SDA waste. EG&G Idaho (1994) provides profile data sheets for the nonradiological and the radiological contaminants separately.

The profile data sheets provide a quick reference summary for each of the principal contaminants. Each sheet very briefly lists typical physical and chemical forms and properties of the contaminant, common uses, general presence in the environment, toxicology, and the results of environmental monitoring at the SDA.

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a. EG&G Idaho, Inc., 1994, *A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952–1983*, EGG-WM-10903, June 1994.

CARBON (C)-14

CAS No.: None

Physical Form

Carbon is most commonly seen as a black elemental solid, but is also found as diamonds, an oxidized gas (CO and CO_2), or trapped in a metallic matrix or on the surface of nonmetallic substances.

Chemical Form

Carbon is found in all organic compounds.

Chemical and Physical Properties

Carbon, especially when finely divided, readily oxidizes to CO and CO_2.

Radiological Properties

C-14 is a low-energy beta emitter from natural sources and from nuclear activities. No gamma rays result from C-14 decay. The half-life is 5,730 years.

Common Uses

The natural presence of C-14 in the environment is used by scientists to age-date archeological artifacts containing carbon. It is also used as a radiation source in thickness gauges and as a tracer in organic chemistry procedures.

General Presence in the Environment

C-14 occurs naturally in the environment due to the action of cosmic radiation in the upper atmosphere. In addition, the atmospheric testing of nuclear weapons and the nuclear fuel cycle have added to the world-wide inventory of C-14. Very small amounts of C-14 are found in all living things.

Radiotoxicology Highlights

Due to its low beta energy and the absence of gamma radiation, C-14 is principally an internal hazard. It is readily absorbed into biological systems and tissue. C-14 may preferentially concentrate in one or more parts of the body depending on the nature of the chemical compound into which it has been incorporated, but in general it deposits throughout all parts of the body.

Environmental Monitoring Results at the SDA

Since C-14 is ubiquitous in the environment, no effort has been made to monitor C-14 at the SDA.